

Claims

- [c1] 1.A magnetic field generating device, comprising:
an arrangement comprising a plurality of permanent magnets (PM), each permanent magnet having a north end and a south end, and each aligned in the same north-south orientation, the PM arrangement configured to have a surface at the north polarity end, a surface at the south polarity end, or a surface at both ends; and
a layer comprising a ferromagnetic material securely disposed at one of the surfaces of the PM arrangement;
wherein the layer has a thickness equal to or less than about 15 millimeters.
- [c2] 2.The device of Claim 1, wherein the layer has a thickness equal to or less than about 5 millimeters.
- [c3] 3.The device of Claim 2, wherein the layer has a thickness equal to or less than about 2 millimeters.
- [c4] 4.The device of Claim 3, wherein the layer has a thickness equal to or less than about 1 millimeter.
- [c5] 5.The device of Claim 4, wherein the layer has a thickness equal to or greater than about 0.1 millimeters.

- [c6] 6.The device of Claim 5, wherein the layer has a thickness equal to or greater than about 0.2 millimeters.
- [c7] 7.The device of Claim 1, wherein the layer comprises a unilayer absent a plurality of laminations.
- [c8] 8.The device of Claim 1, further comprising:
at least one permanent magnet shim disposed at an opposite side of the layer to the PM arrangement.
- [c9] 9.The device of Claim 8, wherein the at least one shim has a polarity the same as that of the PM arrangement.
- [c10] 10.The device of Claim 8, wherein the at least one shim has a polarity different from that of the PM arrangement.
- [c11] 11.The device of Claim 8, wherein the at least one shim comprises a first shim having a polarity the same as that of the PM arrangement, and a second shim having a polarity different from that of the PM arrangement.
- [c12] 12.The device of Claim 1, wherein the layer is adhered to the PM arrangement with adhesive.
- [c13] 13.The device of Claim 8, wherein:
the at least one permanent magnet shim is adhered to the layer.
- [c14] 14.The device of Claim 1, wherein:

the layer is segmented.

- [c15] 15. The device of Claim 1, further comprising:
a B_0 field that varies less than or equal to 1 Gauss from a target value.
- [c16] 16. A method for shimming a magnetic field generating device, comprising:
positioning a plurality of permanent magnets (PM) to form an arrangement, each permanent magnet having a north end and a south end, and each aligned in the same north-south orientation, the plurality positioned to have a surface at the north polarity end of the PM arrangement, a surface at the south polarity end of the PM arrangement, or a surface at both ends of the PM arrangement; and
positioning a layer comprising a ferromagnetic material to be securely disposed at one of the surfaces of the PM arrangement;
wherein the layer has a thickness equal to or less than about 15 millimeters.
- [c17] 17. The method of Claim 16, further comprising:
securely fixing the layer to the PM arrangement.
- [c18] 18. The method of Claim 17, wherein the securely fixing comprises securely fixing the layer to the PM arrange-

ment using adhesive.

- [c19] 19.The method of Claim 16, further comprising:
positioning at least one permanent magnet shim to a side of the layer opposite that of the PM arrangement.
- [c20] 20.The method of Claim 16, wherein the layer comprises a unilayer absent a plurality of laminations.
- [c21] 21.A magnetic field generating device, comprising:
a permanent magnet having a north polarity end and a south polarity end, and a surface at the north polarity end, at the south polarity end, or at both ends; and
a layer comprising a ferromagnetic material securely disposed at one of the surfaces of the permanent magnet; wherein the layer has a thickness equal to or less than about 15 millimeters.
- [c22] 22.The device of Claim 21, further comprising:
at least one permanent magnet shim disposed at an opposite side of the layer to the permanent magnet, the at least one shim comprising a first shim having a polarity the same as that of the permanent magnet, and a second shim having a polarity different from that of the permanent magnet.
- [c23] 23.The device of Claim 22, wherein:
the layer comprises a unilayer absent a plurality of lami-

nations; and
the unilayer is adhered to the permanent magnet.

[c24] 24.A method for shimming a magnetic field generating device, comprising:
positioning a plurality of permanent magnets (PM) to form an arrangement, each permanent magnet having a north end and a south end, and each aligned in the same north-south orientation, the plurality positioned to have a surface at the north polarity end of the PM arrangement, a surface at the south polarity end of the PM arrangement, or a surface at both ends of the PM arrangement;
forming a shim assembly having a layer comprising a ferromagnetic material securely disposed at a pole face of a PM shim; and
securely positioning the shim assembly at a surface of the PM arrangement, the layer of the shim assembly being positioned proximate the surface of the PM arrangement;
wherein the layer has a thickness equal to or less than about 15 millimeters.

[c25] 25.The method of Claim 24, further comprising:
securely fixing the layer to the PM shim.

[c26] 26.The method of Claim 25, further comprising:

securely fixing the shim assembly to the PM arrangement.

[c27] 27.The method of Claim 26, wherein the layer comprises a unilayer absent a plurality of laminations.

[c28] 28.A magnetic field generating device, comprising:
a permanent magnet having a north polarity end and a south polarity end, and a surface at the north polarity end, at the south polarity end, or at both ends;
a non-ferromagnetic shim plate having a plurality of pockets, the shim plate disposed at the surface of the permanent magnet;
a transition layer comprising a ferromagnetic material securely disposed at one or more of the pockets of the shim plate; and
a permanent magnet shim disposed at an opposite side of the layer to the permanent magnet;
wherein the layer has a thickness equal to or less than about 15 millimeters.

[c29] 29.The device of Claim 28, wherein:
the permanent magnet shim comprises a first shim having a polarity the same as that of the permanent magnet, and a second shim having a polarity different from that of the permanent magnet, the first and second shims being disposed at separate pockets.

[c30] 30.The device of Claim 28, wherein:
the layer comprises a unilayer absent a plurality of laminations.

[c31] 31.The device of Claim 30, wherein:
the layer is molded integral to the shim plate.